

WHAT IS CLAIMED IS:

- 10028734-122801
1. A method of forming a penetration hole for a through hole in a thermosetting resin copper-clad laminate having at least two copper layers, in which copper foils of the thermosetting resin copper-clad laminate are processed with an energy of 20 to 60 mJ/pulse sufficient for removing the copper foils by means of the pulse oscillation of a carbon dioxide gas laser, the method comprising forming or disposing a coating or a sheet of an organic substance containing 3 to 97 % by volume of at least one powder selected from the group consisting of a metal compound powder, a carbon powder and metal powder which have a melting point of at least 900°C and a bond energy of at least 300 KJ/mol on at least a copper foil surface to be irradiated with the carbon dioxide gas laser, and irradiating a surface thereof with necessary pulses of the carbon dioxide gas laser to form the penetration hole.
  2. A method according to claim 1, wherein the organic substance is a water-soluble resin composition.
  3. A method according to claim 1, wherein, after the penetration hole is formed, both the copper foil surfaces are etched to remove part of the thickness thereof and form a smooth surface and at the same time to remove copper foil burrs fluffing on a penetration hole portion.
  4. A method according to claim 3, wherein the etching is carried out to remove 1/3 to 1/2 of the thickness of the copper foil.

5. A method according to claim 1, wherein the metal compound powder, the carbon powder and the metal powder have an average particle diameter of 1  $\mu\text{m}$  or less.

5 6. A method according to claim 1, wherein coatings or sheets of an organic substance containing 3 to 97 % by volume of at least one powder selected from the group consisting of a metal compound powder, a carbon powder and metal powder which have a melting point of at least 900°C  
10 and a bond energy of at least 300 KJ/mol are formed or disposed on copper foil surfaces of 2 to 10 copper-clad laminates, one coating or sheet on the copper foil surface of one copper-clad laminate, the 2 to 10 copper-clad  
15 laminates are stacked, and the upper surface of the stacked copper-clad laminates is irradiated with the carbon dioxide gas laser to form the penetration holes at the same time.

7. A method according to claim 1, wherein a backup sheet having a resin layer and a metal plate is at least  
20 partially bonded to an outermost copper foil surface of the copper-clad laminate opposite to a surface of the copper foil to be irradiated with the carbon dioxide gas laser.

8. A method according to claim 7, wherein the resin  
25 layer is formed of a water-soluble resin composition, the resin layer is placed on the copper foil surface and the backup sheet is laminated on the copper foil surface under heat and pressure.

30 9. A method according to claim 7, wherein the resin layer of the backup sheet has a thickness of 20 to 200  $\mu\text{m}$ .

10. A method according to claim 9, wherein the metal plate is a glossy metal plate having a thickness of 30 to 200  $\mu\text{m}$ .

5 11. A copper-clad laminate for use in a method of forming a penetration hole for a through hole in a thermosetting resin copper-clad laminate having at least two copper layers, in which copper foils of the thermosetting resin copper-clad laminate are processed with  
10 an energy of 20 to 60 mJ/pulse sufficient for removing the copper foils by means of the pulse oscillation of a carbon dioxide gas laser, the copper-clad laminate being a copper-clad laminate containing a prepreg of a glass fabric  
15 containing a thermosetting resin having a glass transition temperature of at least 150°C and 10 to 60 % by weight an insulating inorganic filler, the copper-clad laminate having a cross section wherein the thermosetting resin and the inorganic filler from the resin composition are  
20 homogeneously mixed.

12. A copper-clad laminate according to claim 11, wherein the thermosetting resin composition contains 0.1 to 10 % by weight of a black or brown dye or pigment.

25 13. An auxiliary material which is for use on a copper foil surface of a copper-clad laminate when a penetration hole is made in the copper-clad laminate with a carbon dioxide gas laser by irradiating the copper foil  
30 surface with an energy of 20 to 60 mJ/pulse sufficient by means of the pulse oscillation of a carbon dioxide gas laser, and which is a coating or a sheet of an organic

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substance containing 3 to 97 % by volume of at least one powder selected from the group consisting of a metal compound powder, a carbon powder and metal powder which have a melting point of at least 900°C and a bond energy of at least 300 KJ/mol.

14. An auxiliary material according to claim 13, wherein the organic substance is a water-soluble resin composition.

15. An auxiliary material according to claim 13, wherein the sheet is a product formed by bonding a water-soluble resin composition to one surface of a thermoplastic film.

16. An auxiliary material according to claim 15, wherein the sheet is a product in which the total thickness of the layer of the water-soluble resin composition and the thermoplastic film is 30 to 200  $\mu\text{m}$ .

17. An auxiliary material according to claim 15, wherein the sheet is used by disposing the layer of the water-soluble resin composition on the copper foil surface side and laminating the layer of the water-soluble resin composition to the copper foil under heat under pressure.

18. An auxiliary material according to claim 15, wherein the sheet is used by wetting the surface of the layer of the water-soluble resin composition 3  $\mu\text{m}$  or less deep with water in advance, disposing the layer of the water-soluble resin composition on the copper foil surface side and laminating under pressure at room temperature.

19. A backup sheet for making a hole with a carbon dioxide gas laser, which is for use on a reverse outermost copper foil surface of a copper-clad laminate when a hole  
5 is made in the copper-clad laminate with a carbon dioxide gas laser by irradiating a front copper foil surface with an energy of 20 to 60 mJ/pulse by means of the pulse oscillation of a carbon dioxide gas laser and which comprises a 20 to 200  $\mu\text{m}$  thick resin layer and a metal  
10 plate.

20. A backup sheet according to claim 19, wherein the resin layer is a water-soluble resin composition.